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☐ 1. Document ID: US 20050123728 A1

AB: A plywood laminate having dimensional stability and resistance to warping and delamination is formed from a plurality of higher quality plies and a plurality of lower quality plies. The higher quality plies may be of hardwood and the lower quality plies may be of softwood or lower quality hardwoods, or the higher quality plies may have a veneer grade of better than ANSI/HPVA HP-1-2000 veneer grade C and the lower quality plies may have a veneer grade of no greater than ANSI/HPVA HP-1-2000 veneer grade C. The exposed plies are of the higher quality. In most embodiments, at least two adjacent interior plies are of the lower quality. In those embodiments having a tongue and groove or click-lock edge configuration, the tongue comprises portions of at least two plies and at least one of the plies is a higher quality ply.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Des

☐ 2. Document ID: US 20020100565 A1

AB: A structural biocomposite material that incorporates small strands of agricultural straw, typically non-wood cellulosic straws, such as cereal grain straw.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw. Des

☐ 3. Document ID: US 5130184 A

AB: A novel, non-combustible thin coating, applied as an air-setting paint, is used to form a coherent fire-barrier on or between susceptible wood or plastic substrates, or other substances. Consisting of a paint-like slurry of three separate but compatible and mutually synergistic co-bonding systems, viz. magnesium "oxychloride" cement, plus high alumina mono-calcium aluminate cement, plus colloidal silica dispersed in dimethyl formamide (DMF), and utilizing an aqueous solution of magnesium chloride as the common hydrating fluid for the two cements, the coating retains its structural integrity through prolonged exposure to flame temperatures of 2000.degree. F. The coating takes advantage of its brilliant whiteness to act as a thermal radiation reflector for the high radiation component of most flames. Used alone, or in combination with structural reinforcing geotextiles, such as non-woven spunbonded polyester

fabric, or woven and non-woven fiberglass or other natural or synthetic fabrics to form a laminate, the coating, while serving only transitorily as a heat barrier, effectively prevents the ignition of and flame spread of fire on the coated substrate. When placed between substrates at the partial sacrifice of the surface directly exposed to flame, it protects the back-substrate, and thus maintains structural integrity, as well as preventing the spread of flame to adjacent areas. The coating thus acts as a "fire-barrier" for which there are numerous applications.

☐ 4. Document ID: US 4661398 A

AB: A novel method is presented for converting plywood, wall panelling, and laminated sheathing (doorskin, resin-impregnated paper generally termed "Mica", and other combinations of laminated wood and/or wood plastic products) used in construction, into a fire barrier which not only decreases the spread of flame along the surface, but prevents the penetration of flame into the interior of the product and through to the opposite side, and thus enables these products to function as a "fire-barrier" under ordinary fire conditions normally associated with home, apartment, commercial, industrial, ship/boat and aircraft fires.

The method consists of substituting a non-combustible, high temperature-resistant coating, which in itself has adequate adhesive properties to substitute for the presently used adhesives in the laminated wood and wood/plastic structures, for one or more of the adhesive layers, herein termed the internal or "submerged" coatings. The coating may be used alone, or in the form of an impregnated sheet of woven or non-woven fabric made from fiberglass, carbon, aramid ("Kevlar"), quartz, polyester, nylon, or other natural or synthetic or inorganic fibers. The impregnated fabric adds tensile strength and flexural modulus to the laminate and may be used as the bonding agent (adhesive) alone or in combination with the currently used adhesives (e.g. phenol-formaldehyde, urea formaldehyde, resorcinol, melamine, melamine urea, urea, etc.). The cited examples consist of a synergistic combination of two and three non-combustible inorganic bonding systems: viz. magnesium "oxychloride" or magnesium "oxysulphate" cements, along with high alumina calcium aluminate cement; and with or without colloidal silica. These non-combustible formulations are compatible with some of the currently used plywood phenolic, urea and resorcinol adhesives, and may be mixed together so that only one application and curing cycle is required and still imparts the fire-barrier properties inherent in the coating and coating laminate.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw Des

☐ 5. Document ID: US 4572862 A

AB: A novel, non-combustible thin coating, applied as an air-setting paint, is used to form a coherent fire-barrier on or between

susceptible wood or plastic substrates, or other substances. Consisting of a paint-like slurry of three separate but compatible and mutually synergistic co-bonding systems, viz. magnesium "oxychloride" cement, plus high alumina mono-calcium aluminate cement, plus colloidal silica dispersed in dimethyl formamide (DMF), and utilizing an aqueous solution of magnesium chloride as the common hydrating fluid for the two cements, the coating retains its structural integrity through prolonged exposure to flame temperatures of 2000.degree. F. The coating takes advantage of its brilliant whiteness to act as a thermal radiation reflector for the high radiation component of most flames. Used alone, or in combination with structural reinforcing geotextiles, such as non-woven spun-bonded polyester fabric, or woven and non-woven fiberglass or other natural or synthetic fabrics to form a laminate, the coating, while serving only transitorily as a heat barrier, effectively prevents the ignition of and flame spread of fire on the coated substrate. When placed between substrates at the partial sacrifice of the surface directly exposed to flame, it protects the back-substrate, and thus maintains structural integrity, as well as preventing the spread of flame to adjacent areas. The coating thus acts as a "fire-barrier" for which there are numerous applications.

☐ 6. Document ID: US 4361612 A

AB: A lamina for a medium density structural board made from dimensioned wood flakes cut from a mixture of hardwood species and having a high retained internal bond strength is disclosed. The wood flakes are blended with a phenol formaldehyde resin having a major quantity of a low molecular weight fraction and a wax and then formed into a hot pressed product. The lamina may be used alone or as the core of a structural board having veneer, hardboard or plywood face panels. Three or more lamina may be formed into a structural board or used as the core of a board having veneer, hardboard or plywood face panels.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw. Des

☐ 7. Document ID: US 4234658 A

AB: Wood can be hot-pressed into various composites using as adhesive subdivided plant foliage. Considerable bond strength is achieved, the bonds having water resistance adequate for many uses. The foliage is the primary adhesive i.e., is greater than 95% wt. of the active adhesive components present. The foliage can be used either in the form of a powder or as a dispersion in an aqueous liquid carrier. The foliage-wood system is hot-pressed to achieve the desired bonding, the pressing temperature being above the softening temperature of the foliage. The softening temperature of the foliage varies depending on the moisture content. The foliage proportions in the composite can range from about 1% to about 60% by wt. or more in some cases. Increased bond strengths have been achieved using formaldehyde crosslinking agents or alkaline additives.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw Des

8. Document ID: US 4085076 A

AB: A carbohydrate-phenolic resol resin and a process for production of same wherein an aldose saccharide, preferably a hexose, is reacted with a phenolic compound and urea in the presence of an acid catalyst to form a liquid fusible resin which is reacted with a lower aliphatic aldehyde in the presence of a basic catalyst to form said resol resin.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw Des

9. Document ID: WO 2005060507 A2, US 20050123728 A1

AB: NOVELTY - A plywood laminate (1) comprises higher grade wood plies (4), a lower grade wood plies (5) and an adhesive (7) between the adjacent plies adhering the plies together. The higher grade plies have a veneer grade of better than ANSI/HPVA HP-1-2000 veneer grade C and the lower grade plies have a veneer grade not greater than ANSIHPVA HP-1-2000 veneer grade C.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a decorative plywood laminate comprising a decorative ply (2) and a substrate (3) comprising the above plywood laminate.

USE - For decorative plywood laminate for, e.g. floating floor.

ADVANTAGE - The plywood laminate has dimensional stability and resistance to warping and delamination. It uses less expensive wood plies and permits the use of click-lock edge structures.

DESCRIPTION OF DRAWING(S) - The figure is a cross-sectional view of the plywood laminate.

Plywood laminate 1

Decorative ply 2

Substrate 3

Ply 4, 5

Adhesive 7

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw Des

☐ 10. Document ID: US 3563844 A

AB: No data.

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw Des

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☐ 1. Document ID: US 20050123728 A1

Using default format because multiple data bases are involved.

L3: Entry 1 of 2 File: PGPB Jun 9, 2005

PGPUB-DOCUMENT-NUMBER: 20050123728
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20050123728 A1

TITLE: Plywood laminate having improved dimensional stability and resistance to warping and delamination

PUBLICATION-DATE: June 9, 2005

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
Reichwein, David P.	Elizabethtown	PA	US	
Kim, Moon Gi	Starkville	MS	US	
Qiao, Fang	Lancaster	PA	US	

US-CL-CURRENT: 428/192; 428/213, 428/529, 428/535

Full | Title | Citation | Front | Review | Classification | Date | Reference | Sequences | Attachments | Claims | KWIC | Draw D

☐ 2. Document ID: WO 2005060507 A2, US 20050123728 A1

L3: Entry 2 of 2 File: DWPI Jul 7, 2005

DERWENT-ACC-NO: 2005-433934
DERWENT-WEEK: 200547
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TITLE: Plywood laminate for, e.g. floating floor, comprises higher grade wood plies, lower grade wood plies, and adhesive between adjacent plies adhering the plies together

Full | Title | Citation | Front | Review | Classification | Date | Reference | Claims | KWIC | Draw D

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Terms	Documents

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L10: Entry 3 of 5 File: PGPB Oct 30, 2003

PGPUB-DOCUMENT-NUMBER: 20030201054
PGPUB-FILING-TYPE: new
DOCUMENT-IDENTIFIER: US 20030201054 A1

TITLE: One step multiple-ply panel pressing

PUBLICATION-DATE: October 30, 2003

INVENTOR-INFORMATION:

NAME	CITY	STATE	COUNTRY	RULE-47
McPherson, James	Longlac		CA	

APPL-NO: 10/ 133838 [PALM]
DATE FILED: April 26, 2002

INT-CL: [07] B27 D 1/04, B32 B 31/04, B32 B 31/20, B27 D 1/06, B27 D 1/00
US-CL-PUBLISHED: 156/87; 156/154, 156/153, 156/257, 156/307.7
US-CL-CURRENT: 156/87; 156/153, 156/154, 156/257, 156/307.7

REPRESENTATIVE-FIGURES: 1

ABSTRACT:

A method for making in a single step a multiple-ply panel comprising the steps of forming and sandwiching a raw mat assembly of resinated furnish between two sheets of green incised wood veneer, applying a layer of thermosetting high-moisture tolerant adhesive at interfaces between the green veneer and core mat, and applying pressure and heat to cure the consolidated panel assembly for a duration sufficient to secure good internal bond within the substrate panel.

FIELD OF THE INVENTION

[0001] This invention relates to the manufacture of plywood. More particularly, this invention relates to the manufacture of plywood having a resinated mat core such as a waferboard core.

BACKGROUND OF THE INVENTION

[0002] Hardwood plywood is defined in the ANSI/HPVA HP-1-2000standard as, "A panel composed of an assembly of layers or plies of veneer or veneers in combination with a lumber core, particleboard core, MDF core, hardboard core, or of special core material joined with an adhesive. Except for special constructions, the grain of alternate plies is at right angles and the face veneer is a hardwood species."

[0003] Traditionally hardwood plywood was made by "peeling" tree stems on a large rotary lathe to yield wet veneers of uniform thickness. The wet veneers were next clipped to uniform width and stacked in separate bins by grade. Then they were dried in roller dryers to remove excessive moisture as required for gluing and

pressing, sorted again into different grades, repaired for natural defects and conditioned for uniform moisture content. Conditioned veneers were next coated with appropriate glue between adjacent plies, laid up in a veneer assemblies having face and back veneer as outer faces with respective grain angles along a "major axis", centres and intermediate plies with respective grain angles perpendicular to the face and back veneers, and a core which is an inner ply with a respective grain angle in the same direction as that of the outer plies.

[0004] The face and back veneers usually consist of thin decorative veneers from, such wood species as oak, cherry, birch, maple, etc. The inner plies were usually made from aspen, spruce and other lower cost species. The glued veneer assemblies were pre-pressed as a single stack for moisture equalization and tack build-up, and pressed in a multi-opening hot press into plywood panels. The final thickness of hardwood panels varied according to the number of plies.. Each pressed plywood panel was held together by the cured resin bond. After conditioning in hot stacks, these plywood panels were trimmed to size (usually 4ft .times.8 ft or 1.2 m .times.2.4 m in nominal size), patched for external defects, and sanded to meet the product specification requirements.

[0005] More recently a process has been developed to substitute the veneer inner plies for a homogenous wafercore (a term for waferboard used as core) to simplify and improve the consistency of the core material. By adding intermediate plies of veneer on each side, the resulting wafercore substrate provides a uniform and stable surface for thin decorative veneers.

[0006] "Waferboard" is defined in CSA 0437.0-93 as, "A panel containing layers of only randomly placed wafers." "Wafers" in turn are defined as, "a specific type of wood flake produced as a primary function of specialized equipment (i.e. a waferizer) and having a controlled length of at least 30 mm (11/4 inch) along the grain direction, a controlled thickness, and a variable or controlled width. Each wafer is essentially flat and has the grain of the wood running predominantly in the plane of the wafer. In overall character, wafers resemble small pieces of thin veneer. Wafers purposely produced with a narrow width to facilitate alignment are called strands."

[0007] The more recent process yields a balanced panel of stressed-skin construction for industrial application with superior strength, good dimensional stability, good machinability and decorative advantage with less thickness variation and lower formaldehyde emissions than more traditional plywood panels. Either process has similar drawbacks in requiring the drying of green veneer which requires labour and time to monitor and control the drying conditions, plus costly natural gas as a purchased fuel to provide heat for the dryers.

[0008] Either process involves a significant amount of handling in the drying of the green veneer. The purchase and operation of a dryer represents capital and maintenance costs.

[0009] It is an object of the present invention to provide a faster and more economical process for the manufacture of composite plywood.

SUMMARY OF THE INVENTION

[0010] A method for making a multiple-ply wood composite panel including the steps of:

[0011] (i) forming a panel substrate by sandwiching a mat of resinated furnish between two sheets of green incised wood veneer;

[0012] (ii) applying a thermosetting and moisture compatible interface adhesive between the wet veneer sheets and resinated furnish to form an unconsolidated panel;

[0013] (iii) applying pressure and heat to the unconsolidated panel in an amount and for a duration sufficient to cure the resin and the adhesive to form said composite panel.

[0014] The resinated furnish may be formed from wood wafers, wood strands, wood particles, wood fibres, wood veneer and lumber. In one embodiment the resinated finish is of random wafers.

[0015] Preferably, the sheets of green veneer are selected to be within a similar range of moisture content through a moisture sorting system in the ranges of 30% to 49%, 50% to 80%, 81% to 100% and over 100% based on an oven-dry method.

[0016] The interface adhesive may be an MDI resin system or equivalent in moisture resistance to be applied at a rate from 35 to 70 grams per square meter depending on wood species, surface roughness and moisture content of veneer. The resin may be cured at a temperature of from 130.degree. C. to 190.degree. C. and a pressure of from 24 to 28 kg/cm.sup.2 for a duration of 4 to 6 minutes.

[0017] Heat may be applied from opposed hot press platens having a surface temperature of from 200.degree. C. to 220.degree. C. Resin curing time may be from 14 to 18 seconds/mm thickness depending on the board thickness, veneer moisture content and the type of adhesive system used.

[0018] Powder or liquid phenolic adhesives may be used for the resinated finish and may be applied in amounts from 1.75% to 2.5% by weight (dry basis) for a composite core material depending on the grade requirement. Alternatively, regular or fortified low-fume resins may be used for interior grade panels.

[0019] The depth of incision on green veneer sheets may be all the way through their respective thicknesses.

[0020] The composite panels formed as described above may be further sanded on one or both sides after pressing for lamination with thin decorative veneers as final face and/or back coverings.

DESCRIPTION OF THE DRAWINGS

[0021] Preferred embodiments of the present invention are described below with reference to the accompanying illustrations in which:

[0022] FIG. 1 is a schematic diagram illustrating a multiple-ply panel pressing process according to the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0023] FIG. 1 illustrates a multiple-ply panel 10 between opposed platens 20 of a typical hot press. The balance of the hot press is not illustrated but would typically be steam or thermal-oil heated and of known construction. Representative of a suitable hydraulic hot press is a MULTI-DAYLIGHT.RTM. steam heated press with simultaneous arm closing and an electronic press controller. Alternatively, a continuous hot press with proper set-up can be used to achieve a similar result.

[0024] The panel 10 includes a mat of resinated furnish hereinafter referred to as "a resinated mat" 12 sandwiched between two sheets of green incised wood veneer 14. "Resinated furnish" is a term used to refer to wafers in combination with phenolic resins prior to consolidation. Between the veneer sheets 14 and the resinated mat 12 is a layer of thermosetting moisture-tolerant adhesive 16.

[0025] The panel 10 may initially be formed as an unconsolidated panel with two veneer sheets 14 coated with adhesive 16 applied to an inner face 22 of the sheets 14 or alternatively to the resinated mat 12 before overlaying the veneer sheets 14 over the resinated mat 12.

[0026] The unconsolidated panel I then pressed between the hot press platens 20 to cure the resinated furnish and set the interface adhesive and form the consolidated panel 10. The surface temperature of the platens 20, the type of resin and adhesive, the amount of resin and adhesive 16, the pressure and duration of heating and pressing must be selected to suit the dimensions and the grade of the panel being pressed. Using the pressing parameters set out below as a guideline, a skilled press operator can optimize the pressing strategy for a specific product.

[0027] The incising of veneer is becoming a common practice in the plywood industry. Basically, it involves using a proprietary cutter to make incisions in the veneer. The incisions may extend partially or completely through the veneer. The purpose of the incising is to provide a conduit for steam formed during hot pressing to escape easily through the veneer and avoid undesirable delamination due to blows and blisters at the end of the pressing cycle. Preferably the green wood veneer for the present process is incised completely through the veneer thickness, and the incisions are regularly spaced throughout the entire veneer sheet 14.

[0028] As the adhesive 15, an MDI resin (isocyanate resin) or an equivalent resin system can be applied at the rate from 35 to 70 grams per square meter depending on wood species, surface roughness and moisture content of veneer.

[0029] As a wafercore binder, a combination of "slack wax" and powdered or liquid phenolic resin may be used. Slack wax or emulsified wax would first be applied to the wood furnish at the rate from 0.75% to 1.0% by weight. Phenolic resin is subsequently applied at the rate from 1.75 to 2.5% by weight (oven-dry basis). Alternatively other resin systems such as high-moisture resistant low-fume fortified urea-formaldehyde resin can be applied as well.

[0030] The hot press platens would typically have a surface temperature from 190.degree. C. to 220.degree. C. depending on the resin system and moisture content of the mat assembly. Typical pressing time 14-18 seconds/mm of board thickness.

[0031] To ensure a balanced panel, both sheets 14 of incised green wood veneer within the unconsolidated panel should be selected to be within a similar range of moisture content. In practice, it has been found that the green veneer can be sorted into moisture groups having 30% to 49%, 50% to 80%, 81% to 100% and greater than b 100% moisture based on oven-dry weight of the veneer.

[0032] Hot pressing typically generates steam from water inside the green veneer which in turn "injects" itself inwardly through the incisions. This drives the heat faster into the core layer and assists in the wood plasticization and resin curing process. The process requires a high-moisture tolerant adhesive that cannot be washed out by steam.

[0033] Once resins inside the unconsolidated panel 10 have been cured, the resultant consolidated panel 10 may be sanded and hardwood veneer applied to one or both sides in a normal veneering process similar to hardwood plywood.

[0034] Thus the above process produces a multiple-ply panel in one step and eliminates the need to dry, sort and otherwise process the wet wood veneer. It also eliminates the need for a veneer dryer or the use of natural gas as a fuel source. The platens 20 may be steam heated and the fuel for generating the steam may be wood waste hence converting scrap into fuel rather than requiring natural gas.

[0035] The above description is intended in an illustrative rather than a restrictive sense. Variations to the exact process parameters set out may be apparent to those skilled in the relevant art without departing from the scope of the invention as defined by the claims set out below.

CLAIMS:

1. A method for making a multiple-ply panel wood composite comprising the steps of: (i) forming a panel substrate by sandwiching a resinated mat between two sheets of green incised wood veneer; (ii) applying a thermosetting and moisture compatible adhesive between the veneer sheets and the resinated mat to form an unconsolidated panel; (iii) applying pressure and heat to the unconsolidated panel in an amount and for a duration sufficient to cure the resin and the adhesive, to form said composite panel.

2. The method of claim 1 wherein: said resinated mat is formed from at least one member selected from the group consisting of wood wafers, wood strands, wood particles, wood fibres, wood veneer and lumber.

3. The method of claim 2 wherein: said resinated mat is of randomly oriented wafers or strands.

4. The method of claim 3 wherein: said sheets of green veneer are selected to be within a close range of moisture contents.

5. The method of claim 4 wherein: said sheets of green veneer are selected from common groups of sheets sorted into moisture ranges of from 30% to 49%, 50% to 80%, 81% to 100% and over 100% based on the dry weight of said sheets.

6. The method of claim 5 wherein: said green veneer ranges from 2.5 mm ({fraction (1/10)}"), 3 mm ({fraction (1/8)}") to 4 mm ({fraction (1/7)}") in thickness, 1.22 m.times.2.44 m (4ft.times.8ft) and 1.0 m.times.2.0 m (3 ft.times.6 ft) in nominal sizes.

7. The method of claim 1 wherein: said adhesive is an MDI resin or equivalent resin system; said adhesive is applied to a rate of from 35 to 70 grams per square meter; said adhesive is cured at a temperature of from 130.degree. C. to 190.degree. C., at a specific pressure of from 24 to 28 kg/cm.sup.2 and for 12-16 seconds/mm of panel thickness.

8. The method of claim 1 wherein: said resinated mat includes a binder which is a powder or liquid phenolic resin applied with slack or emulsified wax.

9. The method of claim 8 wherein: said binder is applied in an amount of from 1.75% to 2.5% by weight of wood flakes on an oven-dry basis.

10. The method of claim 7 wherein; said resinated mat includes a binder which is a powder or liquid phenolic resin applied with slack of emulsified wax.

11. The method of claim 10 wherein: said binder is applied in an amount of from 1.75% to 2.5% by weight of wood flakes on an oven-dry basis.

12. The method of claims 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 wherein: said green incised wood veneer sheets are incised all the way through their respective thicknesses with incisions equally spaced throughout the veneer sheet.

13. The method of claim 12 including further steps of: (iii) sanding said opposite faces after said curing of said adhesives; and (iv) applying decorative veneer to at least one of said opposite faces.

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